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EXAMINER	
AYAD, TAMIR	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/586,648	YAMANAKA ET AL.	
	Examiner	Art Unit	
	TAMIR AYAD	1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 August 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-61* is/are pending in the application.

4a) Of the above claim(s) *58 and 59* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-57 and 60-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/19/06,12/14/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Species A in the reply filed on August 9, 2010 is acknowledged. The traversal is on the ground(s) that a restriction is not proper unless the restricted group of claims is patentability distinct (i.e., inter alia, non-obvious under 35 U.S.C. 103) from the elected group of claims. This is not found persuasive because Species A, Species B, and Species C are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The requirement is still deemed proper and is therefore made FINAL.

With regard to applicant's argument concerning the generic claims, claims 32-56 and 61 are indeed generic. As stated in the previous office action, upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise require all the limitations of an allowed generic claim.

2. Claims 58 and 59 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on August 9, 2010.

Claim Rejections - 35 USC § 112

3. Claims 55-57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the meaning of the recitation "shapes of the catalyst layers" is unclear. For the purpose of this office action, the recitation will be treated as if it means the number of apertures contained in the catalyst layer of the first photoelectric conversion element differs with respect to the number of apertures contained in the catalyst layer of the second photoelectric conversion element.

Appropriate correction is required.

Further, regarding claim 56, the meaning of the term "aperture parts" is unclear. Specifically, the difference between "aperture parts" and "apertures" is unclear. For the purpose of this office action, the recitation will be treated as if it recites "wherein the catalyst layers of the second photoelectric conversion elements have apertures."

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 32 and 60 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsui et al. (US 2004/0074531).

Regarding claim 32, Matsui discloses a dye-sensitized solar cell module ([0014]) comprising: first photoelectric conversion elements (shown in Figure 2 as the three photoelectric conversion elements nearest the positive electrode) each comprising a transparent conductive layer (2, Figure 2), a porous photoelectric conversion layer adsorbing a dye (semiconductor layer 3, Figure 2; [0014] L15), an electrolytic layer (5, Figure 2), a catalyst layer (4, Figure 2), and a conductive layer (2, Figure 2) laminated in this order on a transparent substrate (1, Figure 2); second photoelectric conversion elements each comprising a transparent conductive layer (2, Figure 2), a catalyst layer (4, Figure 2), an electrolytic layer (5, Figure 2), a porous photoelectric conversion layer adsorbing a dye (semiconductor layer 3, Figure 2), and a conductive layer (2, Figure 2) laminated in this order on a transparent substrate (1, Figure 2); and a supporting substrate formed on the respective conductive layers of the first and second photoelectric conversion elements (1', Figure 2), wherein one or more first photoelectric conversion elements and one or more second photoelectric conversion elements are alternately arranged in parallel between the transparent substrate and the supporting substrate (shown in Figure 2), and the neighboring first photoelectric conversion elements and second photoelectric conversion elements are electrically connected in series ([0024] L20-21).

Regarding claim 60, Matsui discloses all the claim limitations as set forth above. Matsui further discloses wherein the catalyst layers contain Pt ([0015] L3).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 33-34, 40-45 and 47-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) as applied to claim 32 above, in view of Chiba et al. (US 2002/0134426).

Regarding claims 33, 34, 43, 49 and 50, Matsui discloses all the claim limitations as set forth above.

Matsui does not explicitly disclose wherein the first photoelectric conversion elements and the second photoelectric conversion elements are different in at least one among the composition of the electrolytic layers; the thickness of the porous photoelectric conversion layers; the width of the porous photoelectric conversion layers; the average particle diameter of the semiconductor particles composing the porous photoelectric conversion layers.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein first photoelectric conversion elements and second photoelectric conversion elements have semiconductor particles with different average particle diameters ([0011]).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include the semiconductor particles with different average particle diameters in the first and second photoelectric conversion elements disclosed by Matsui, as disclosed in Chiba, because as taught by Chiba, J_{SC} is improved which improves photovoltaic cell efficiency ([0011]).

Further, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. In this case, while modified Matsui does not explicitly disclose wherein a short circuit current of the second photoelectric conversion elements in the case where a light receiving face

thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side is greater than a short circuit current of the first photoelectric conversion elements in the case where a light receiving face thereof is set in the porous photoelectric conversion layer side opposite the catalyst layer side; the different average particle diameters in the respective first and second photoelectric conversion elements of modified Matsui will necessarily produce the difference in short circuit current as evidenced by Chiba ([0009]).

Similarly, while modified Matsui does not explicitly disclose wherein when the short circuit current density of the first photoelectric conversion elements is defined as Jd and the short circuit current density of the second photoelectric conversion elements is defined as Jc, (Jc/Jd)>0.7 is satisfied, where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

Similarly, while modified Matsui does not explicitly disclose wherein open circuit voltage values of the first photoelectric conversion elements are higher than open circuit voltage values of the second photoelectric conversion elements, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or

obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

Regarding claim 40, modified Matsui discloses all the claim limitations as set forth above.

Modified Matsui does not explicitly disclose wherein either the first photoelectric conversion elements or the second photoelectric conversion elements contain lithium iodide in the electrolytic layer thereof.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the photoelectric conversion elements contain lithium iodide in the electrolytic layer thereof ([0118] L9).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the electrolyte layer disclosed in Chiba in the device of Matsui, because as taught by Chiba, the J_{SC} of the resulting device is improved which improves photovoltaic cell efficiency ([0011]). Further, the choice of lithium iodide in an electrolytic layer requires only routine skill in the art because the choice amounts to the use of a known electrolyte material for its intended use in a known environment to produce an expected result.

Regarding claims 41 and 42, modified Matsui discloses all the claim limitations as set forth above.

Modified Matsui does not explicitly disclose wherein the thicknesses of the porous photoelectric conversion layers of the first photoelectric conversion elements and the second photoelectric conversion elements differ.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the thicknesses of the porous photoelectric conversion layers of the first photoelectric conversion elements are thinner than the thicknesses of the porous photoelectric conversion layers of the second photoelectric conversion elements differ ([0079] L10; [0082]] L8).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the thicknesses disclosed in Chiba for the thicknesses of the porous photoelectric conversion layers of the first and second photoelectric conversion elements disclosed by Matsui, because as taught by Chiba, the J_{SC} of the resulting device is improved which improves photovoltaic cell efficiency ([0011]).

Regarding claims 44 and 45, Matsui discloses all the claim limitations as set forth above.

Matsui does not explicitly disclose wherein the light receiving surface areas of the respective porous photoelectric conversion layers of the second photoelectric conversion elements are larger than the light receiving surface areas of the respective porous photoelectric conversion layers of the first photoelectric conversion elements.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the light receiving surface areas of the respective porous photoelectric conversion layers of the second photoelectric conversion elements are larger than the light receiving surface areas of the respective porous photoelectric conversion layers of the first photoelectric conversion elements ([0011] L6-11).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of Matsui such that the light receiving surface areas of the respective porous photoelectric conversion layers of the second photoelectric conversion elements are larger than the light receiving surface areas of the respective porous photoelectric conversion layers of the first photoelectric conversion elements as disclosed by Chiba, because as taught by Chiba, the arrangement leads to a photovoltaic cell having a high efficiency by improving J_{SC} ([0011]).

Regarding claim 47, modified Matsui discloses all the claim limitations as set forth above. Additionally, Chiba discloses wherein the light receiving surface areas of the respective porous photoelectric conversion layers of the first photoelectric conversion elements are the same and the light receiving surface area of the respective porous photoelectric conversion layers of the second photoelectric conversion elements are the same ([0030] L14-18). (Matsui discloses a plurality of first and second photoelectric conversion elements as set forth above).

Regarding claim 48, Matsui discloses all the claim limitations as set forth above.

Modified Matsui does not explicitly disclose wherein a first dye is adsorbed in the respective porous photoelectric conversion layers of a plurality of the first photoelectric conversion elements and a second dye different from the first dye is adsorbed in the respective porous photoelectric conversion layers of a plurality of the second photoelectric conversion elements.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein a first dye is adsorbed in the respective porous photoelectric conversion layers of a first photoelectric conversion element and a second dye different from the first dye is adsorbed in the respective porous photoelectric conversion layers of a second photoelectric conversion element ([0027] L4-6).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the first and second dyes as disclosed in Chiba, in the device of Matsui, because as taught by Chiba, the dyes have different maximum sensitivity wavelength regions ([0027] L5) which would maximize light absorption.

Regarding claim 51, Matsui discloses all the claim limitations as set forth above.

Matsui does not explicitly disclose wherein the average particle diameter of the semiconductor particles of the porous semiconductor layers of the first photoelectric conversion elements is smaller than the average particle diameter of the semiconductor particles of the porous semiconductor layers of the second photoelectric conversion elements.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the average particle diameter of the semiconductor particles of the porous semiconductor layers of the first photoelectric conversion elements is smaller than the average particle diameter of the semiconductor particles of the porous semiconductor layers of the second photoelectric conversion elements ([0011]).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include the semiconductor particles with different average particle diameters in the first and second photoelectric conversion elements disclosed by Matsui, as disclosed in Chiba, because as taught by Chiba, J_{SC} is improved which improves photovoltaic cell efficiency ([0011]).

Regarding claim 52, modified Matsui discloses all the claim limitations as set forth above. Modified Matsui further discloses wherein the porous semiconductor layer of at least each of the second photoelectric conversion elements is composed of a plurality of layers and the average particle diameter of the semiconductor particles in the porous semiconductor layer closest to the supporting substrate is larger than the average particles diameter of the semiconductor particles in the porous semiconductor layer farthest from the supporting substrate (as shown in Figure 2 of Matsui and as set forth above in modified Matsui).

Regarding claims 53 and 54, modified Matsui discloses all the claim limitations as set forth above. Modified Matsui further discloses wherein the porous semiconductor

layer of each of the second photoelectric conversion elements is composed of a plurality of layers and the semiconductor particles with a particle diameter of 100 nm or larger (Chiba – [0081] L3) are contained in the porous semiconductor layer closest to the supporting substrate and the semiconductor particles with an average particle diameter of 30 nm or smaller (Chiba – [0077] L10) are contained in the porous semiconductor layer farthest from the supporting substrate (shown in Figure 2 of Matsui and as set forth above in modified Matsui).

10. Claims 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) in view of Enomoto et al. (JP 2003-333757 A - see English language equivalent US 2005/0268957) as applied to claim 34 above, and further in view of Zaban et al. ("Relative Energetics at the Semiconductor/Sensitizing Dye/Electrolyte Interface").

Regarding claims 35 and 36, modified Matsui discloses all the claim limitations as set forth above.

While modified Matsui does disclose wherein the first photoelectric conversion elements and the second photoelectric conversion elements contain iodine in the respective electrolytic layers (Matsui - [0016] L13), modified Matsui does not explicitly disclose wherein the iodine concentration in the electrolytic layers of the second photoelectric conversion elements is lower than the iodine concentration in the electrolytic layers of the first photoelectric conversion elements.

Zaban discloses a dye-sensitized solar cell module and further discloses that the oxidation potential of the dye used must be more positive than the redox couple in the electrolyte solution to provide the driving force for the hole transfer (P452/C1/L26-28).

Matsui and Zaban are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cell modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the iodine concentration in the electrolytic layers of the second photoelectric conversion elements with respect to the iodine concentration in the electrolytic layers of the first photoelectric conversion elements in order to correspond with the differing dyes used in the first and second photoelectric conversion elements (as set forth in Matsui – [0023] L25), because as taught by Zaban, there is relationship between the dyes used in a photoelectric conversion element and the redox couple in the electrolyte solution (P452/C1/L26-28).

With regard to the relative concentration or ratio of the iodine in the electrolytic layers of the first and second photoelectric conversion elements, one of ordinary skill in the art at the time of the invention would have found it obvious to optimize the iodine concentration (redox couple - Zaban P452/C1/L25) in each of the photoelectric conversion elements to provide the driving force necessary to complement the dye desired to achieve optimal wavelength absorption (different photosensitizing dyes depending on absorption desired as set forth in Matsui [0023]). Therefore, the precise ratio of the iodine concentration in the first and second photoelectric conversion parts would have been considered a result effective variable by one having ordinary skill in

the art at the time the invention was made. As such, without showing unexpected results, the claimed ratio of iodine concentrations in the first and second photoelectric conversion elements cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the ratio of iodine concentrations in the first and second photoelectric conversion elements in the apparatus of modified Matsui to obtain the desired balance between the desired wavelength absorption and the cell performance as evidenced in Zaban (P452/C1/L24-32) (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

11. Claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) as applied to claim 32 above, in view of Zaban et al. ("Relative Energetics at the Semiconductor/Sensitizing Dye/Electrolyte Interface").

Regarding claims 37 and 38, modified Matsui discloses all the claim limitations as set forth above. Matsui further discloses wherein the first photoelectric conversion elements and the second photoelectric conversion elements respectively contain imidazolium salts ([0016] L19).

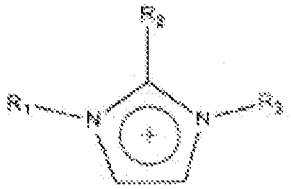
Modified Matsui does not explicitly disclose wherein the imidazolium salts contained in the respective electrolytic layers of the first photoelectric conversion elements and the second photoelectric conversion elements differ in concentration (are different).

It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the concentration of imidazolium salts in one photoelectric conversion element with respect to the other (therefore making them different) because as evidenced by Zaban (P452/C1/L25), the redox couple in the electrolyte solution must be less positive than the oxidation potential of the respective dyes used in the first and second photoelectric conversion elements as set forth in Matsui ([0023]) to provide the driving force necessary to complement the dye chosen to achieve optimal wavelength absorption (different photosensitizing dyes depending on absorption desired as set forth in Matsui [0023]). Therefore, the precise ratio of the imidazolium salt concentration in the first and second photoelectric conversion parts would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed ratio of imidazolium salt concentrations in the first and second photoelectric conversion elements cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the ratio of imidazolium salt concentration in the first and second photoelectric conversion elements in the apparatus of modified Matsui to obtain the desired balance between the desired wavelength absorption and the cell performance as evidenced in Zaban (P452/C1/L24-32) (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

12. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) in view of Zaban et al. ("Relative Energetics at the Semiconductor/Sensitizing Dye/Electrolyte Interface") as applied to claim 37 above, and further in view of Chiba et al. (US 2002/0134426).

Regarding claim 39, modified Matsui discloses all the claim limitations as set forth above.

Modified Matsui does not explicitly disclose wherein the imidazolium salts are salts of compounds defined by the formula:



wherein R_1 and R_2 independently denote a hydrogen atom or methyl; R_3 denotes methyl, ethyl, propyl, butyl, or hexyl.

Chiba discloses a dye-sensitized solar cell module and further discloses wherein the imidazolium salt is dimethylpropylimidazolium iodide ([0066]).

Matsui and Chiba are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar modules.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include the imidazolium salts disclosed by Chiba as the imidazolium salts taught by Matsui, because as disclosed by Chiba, the dye-sensitized photovoltaic cell disclosed can conduct photovoltaic conversion of light of a wide range of spectrum from

the visible region to the near infrared region in the sunlight spectrum and provides a photovoltaic cell having high efficiency by improving J_{SC} ([0011]).

13. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) in view of Chiba et al. (US 2002/0134426) as applied to claim 44 above, and further in view of Wanlass (US 5,322,572).

Regarding claim 46, modified Matsui discloses all the claim limitations as set forth above.

While modified Matsui does disclose a series connection direction of the solar cells (Matsui - [0024] L20-21), modified Matsui does not explicitly disclose wherein the widths of the respective porous photoelectric conversion layers of the first photoelectric conversion elements and the second photoelectric conversion elements differ in the series connection direction of the solar cells.

Wanlass discloses a tandem solar cell and further discloses that a solar cell can be optimized by adjusting the areas of the subcells to match current densities of the two subcells (C8/L49-51).

Matsui and Wanlass are combinable because they are concerned with the same field of endeavor, namely photovoltaic devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the areas of the respective photoelectric conversion layers in the device of Matsui, as disclosed in Wanlass, such that the widths of the first and second photoelectric conversion elements differ, because as taught by Wanlass, the method

optimizes the solar cell by matching the current densities (C8/L51) which is desirable in series connections.

14. Claims 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) as applied to claim 32 above, in view of Lindquist et al. (WO 99/63599).

Regarding claim 55, Matsui discloses all the claim limitations as set forth above.

Matsui does not explicitly disclose wherein the shapes of the catalyst layers of the first photoelectric conversion elements and the catalyst layers of the second photoelectric conversion elements differ.

Lindquist discloses a dye-sensitized solar cell module and further discloses wherein the shapes of the catalyst layers of first and second photoelectric conversion elements differ (P5/L11, P5/L14, Figure 1).

Matsui and Lindquist are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the catalyst layers of Matsui such that their shapes differ as disclosed in Lindquist, because as taught by Lindquist, the semiconductor layers have different bandgaps (abstract L30) and therefore adjusting the shapes of the catalyst layers as disclosed by Lindquist would allow differing amounts of light as desired for different bandgap semiconductor layers.

With regard to the recitation wherein the light transmittance of the catalyst layers of the second photoelectric conversion elements is lower than the light transmittance of

the catalyst layers of the first photoelectric conversion elements, one of ordinary skill in the art at the time of the invention would have found it obvious to rearrange and match the differently shaped catalyst layers disclosed by Lindquist to achieve the desired match with the various wavelengths of absorption targeted in the respective semiconductor layers disclosed in modified Matsui.

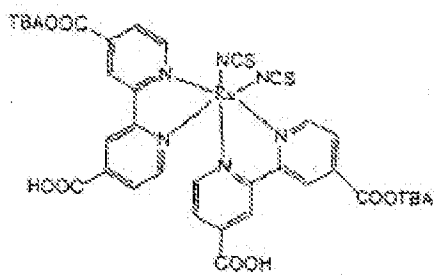
Regarding claim 56, modified Matsui discloses all the claim limitations as set forth above. Modified Matsui further discloses wherein the catalyst layers of the second photoelectric conversion elements have aperture parts (inherently disclosed – layers necessarily have aperture parts on a molecular level).

Regarding claim 57, modified Matsui discloses all the claim limitations as set forth above. Modified Matsui further discloses wherein the catalyst layers of the second photoelectric conversion elements have a lattice-like shape (inherently disclosed – the catalyst layer disclosed, as a layer comprised of molecules arranged together, necessarily has a lattice-like shape).

15. Claim 61 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsui et al. (US 2004/0074531) in view of Chiba et al. (US 2002/0134426) as applied to claim 48 above, further in view of Nazeeruddin et al. (“Investigation of Sensitizer Adsorption and the Influence of Protons on Current and Voltage of a Dye-Sensitized Nanocrystalline TiO_2 Solar Cell”), and further in view of Grätzel (“Perspectives for Dye-sensitized Nanocrystalline Solar Cells").

Regarding claim 61, modified Matsui discloses all the claim limitations as set forth above.

While modified Matsui does disclose a ruthenium dye is adsorbed on the respective porous photoelectric conversion layers of the first photoelectric conversion elements (Chiba - [0113]), modified Matsui does not explicitly disclose wherein a ruthenium dye defined by the formula:

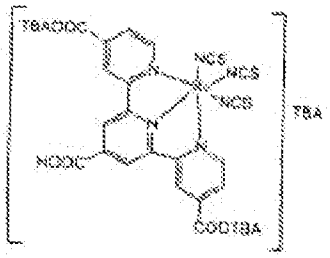


Nazeeruddin discloses a dye-sensitized solar cell and further discloses wherein N719 dye is adsorbed on a porous photoelectric conversion layer of a photoelectric conversion element (P8983/Chart 1).

Matsui and Nazeeruddin are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the ruthenium dye disclosed by Nazeeruddin as the ruthenium dye disclosed in modified Matsui, because the choice amounts to one from among a limited number of possible dyes for use in dye-sensitized solar cells to achieve a known, predictable result.

Modified Matsui does not explicitly disclose a black dye defined by the formula:



is adsorbed on the respective porous photoelectric conversion layers of a plurality of the second photoelectric conversion elements.

Grätzel discloses a dye-sensitized solar cell and further discloses a black dye adsorbed on a porous photoelectric conversion layer of a photoelectric conversion element (Figure 3).

Matsui and Grätzel are combinable because they are concerned with the same field of endeavor, namely dye-sensitized solar cells.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the black dye disclosed by Grätzel as the second dye disclosed in modified Matsui, because the choice amounts to one from among a limited number of possible dyes for use in dye-sensitized solar cells to achieve a known, predictable result.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TAMIR AYAD whose telephone number is 571-270-1188. The examiner can normally be reached on Monday through Friday, 7:30 AM - 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on 571-272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T.A./
Examiner, Art Unit 1725
10/14/2010

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1725